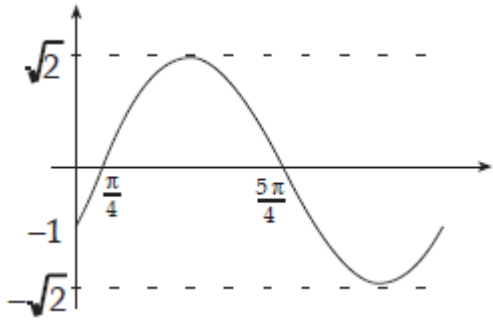
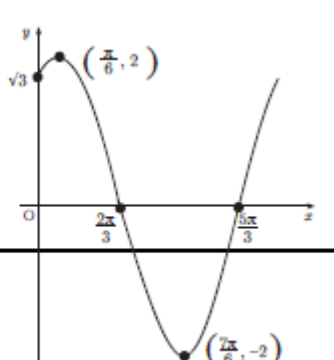


00 P1 B10	6A <ul style="list-style-type: none"> \bullet^1 e.g. use $k \cos(x+a)$ explicitly stated \bullet^2 $k \cos x \cos a - k \sin x \sin a$ explicitly stated \bullet^3 $k \cos a = 1$ and $k \sin a = 1$ \bullet^4 $k = \sqrt{2}$ \bullet^5 $\tan a = 1, a = \frac{\pi}{4}$ \bullet^6 max.value = $\sqrt{2}$ when $x = \frac{7\pi}{4}$
01 P2 Q5	4C <ul style="list-style-type: none"> \bullet^1 $k \cos x \cos a - k \sin x \sin a$ stated explicitly \bullet^2 $k \cos a = 8$ and $k \sin a = 6$ stated explicitly \bullet^3 $k = 10$ \bullet^4 $a = 36.9$ ans: $10 \cos(x + 36.9)^\circ$
02 P1 Q9	4C, 3B <ul style="list-style-type: none"> \bullet^1 $k \sin(x) \cos(a) - k \cos(x) \sin(a)$ explicitly stated \bullet^2 $k \cos(a) = 1$ and $k \sin(a) = 1$ explicitly stated \bullet^3 $k = \sqrt{2}$ \bullet^4 $a = \frac{\pi}{4}$ ans: $\sqrt{2} \sin(x - \frac{\pi}{4})$ \bullet^5 correct shape of graph (ie sin) but not passing through the origin \bullet^6 graph lies between $\sqrt{2}$ and $-\sqrt{2}$ \bullet^7 $(\frac{\pi}{4}, 0), (\frac{5\pi}{4}, 0), (0, -1)$ 
3.(JA N) 02 P2	4C, 2B <ul style="list-style-type: none"> \bullet^1 $k \sin x^\circ \cos a^\circ + k \cos x^\circ \sin a^\circ$ stated explicitly \bullet^2 $k \sin a^\circ = 1$ and $k \cos a^\circ = \sqrt{3}$ stated explicitly \bullet^3 $k = 2$ \bullet^4 $a = 30$ ans: $2 \sin(x + 30)^\circ$ \bullet^5 max = $5 + 2 = 7$ \bullet^6 $x = 60$ ans: max = 7 when $x = 60$
03 P2 Q7	4C, 3B <ul style="list-style-type: none"> \bullet^1 $k \sin(x^\circ) \cos(a^\circ) + k \cos(x^\circ) \sin(a^\circ)$ stated explicitly \bullet^2 $k \cos(a^\circ) = 2, k \sin(a^\circ) = 5$ stated explicitly \bullet^3 $k = \sqrt{29}$ (5.4...) \bullet^4 $a = 68.2^\circ$ ans : $\sqrt{29} \sin(x + 68.2)^\circ$

	<ul style="list-style-type: none"> •⁵ $\sqrt{29} \sin(x + 68.2)^\circ = -\sqrt{29}$ •⁶ $x_P = 201.8^\circ$ •⁷ $y_P = -\sqrt{29}$ <p style="text-align: right;">ans : $(201.8^\circ, -\sqrt{29})$</p>
04 P2 Q6	<p>4C, 3B</p> <ul style="list-style-type: none"> •¹ $k \cos x \cos a + k \sin x \sin a$ <i>STATED</i> •² $k \cos a = 3, k \sin a = 5$ <i>STATED</i> •³ $k = \sqrt{34}$ •⁴ $a = 59$ •⁵ $\sqrt{34} \cos(x - 59)^\circ = 4$ •⁶ $x - 59 = \text{any one of}$ $-46.7, 46.7, 313.3$ •⁷ $x = 12.3$
05 P1 Q10	<p>4C, 5A</p> <ul style="list-style-type: none"> •¹ $k \sin(x) \cos(a) - k \cos(x) \sin(a)$ STATED EXPLICITLY •² $k \cos(a) = 1, k \sin(a) = \sqrt{3}$ STATED EXPLICITLY •³ $k = 2$ •⁴ $a = \frac{\pi}{3}$ •⁵ $y = 3 + 2 \sin\left(x - \frac{\pi}{3}\right)$ <p>a sketch showing</p> <ul style="list-style-type: none"> •⁶ a sinusoidal curve •⁷ y-intercept at $(0, 3 - \sqrt{3})$ and no x-intercepts <div style="display: flex; align-items: center; justify-content: center; margin-top: 20px;"> <div style="flex: 1;"> <ul style="list-style-type: none"> •⁸ max at $\left(\frac{5\pi}{6}, 5\right)$ •⁹ min at $\left(\frac{11\pi}{6}, 1\right)$ <p>OR</p> </div> <div style="flex: 1; text-align: center;"> </div> </div>

	<ul style="list-style-type: none"> •⁵ $\frac{dy}{dx} = \cos(x) + \sqrt{3}\sin(x) = 0$ •⁶ $\tan(x) = -\frac{1}{\sqrt{3}}$ •⁷ max at $(\frac{5\pi}{6}, 5)$ •⁸ min at $(\frac{11\pi}{6}, 1)$ •⁹ $x = 0 \Rightarrow y = 3 - \sqrt{3}$ <i>and annotated sketch.</i>
06 P2 Q10	<p>4C, 3A/B</p> <ul style="list-style-type: none"> •¹ $k\sin(x)\cos(a) - k\cos(x)\sin(a)$ <i>stated explicitly</i> •² $k\cos(a) = 7, k\sin(a) = 24$ <i>stated explicitly</i> •³ $k = 25$ •⁴ $a = 1.29$ 4 marks <ul style="list-style-type: none"> •⁵ $25\sin(x - 1.29)$ •⁶ $\frac{dy}{dx} = 25\cos(x - 1.29) = 1$ •⁷ $x = 2.82$ 3 marks
07 P1 Q11	<p>4C, 4A/B</p> <ul style="list-style-type: none"> •¹ $k\cos(x)\cos(a) + k\sin(x)\sin(a)$ <i>stated explicitly</i> •² $k\cos(a) = \sqrt{3}, k\sin(a) = 1$ <i>stated explicitly</i> •³ $k = 2$ •⁴ $a = \frac{\pi}{6}$ a sketch showing •⁵ max $(\frac{\pi}{6}, \dots)$ and min $(\frac{7\pi}{6}, \dots)$ •⁶ max $(\dots, 2)$ and min $(\dots, -2)$ •⁷ $(\frac{2\pi}{3}, 0)$ and $(\frac{5\pi}{3}, 0)$ •⁸ $(0, \sqrt{3})$ 
08 P2 Q3	<p>2C, 4C, 2C/B</p> <ul style="list-style-type: none"> •¹ $p = \sqrt{7}$ •² $q = -3$ •³ $k\cos x \cos a - k\sin x \sin a$ <i>stated explicitly</i> •⁴ $k\cos a = \sqrt{7}$ and $k\sin a = 3$ <i>stated explicitly</i> •⁵ $k = 4$ •⁶ $a \approx 0.848$ •⁷ $4\cos(x + 0.848)$ •⁸ $-4\sin(x + 0.848)$

10 P2 Q2	<p>use addition formula</p> <p>compare coefficients</p> <p>process k</p> <p>process a</p> <p>state maximum and minimum</p> <p>find x corresponding to max. value</p> <p>find x corresponding to min. value</p>	<p>•¹ $k \cos x^\circ \cos a^\circ - k \sin x^\circ \sin a^\circ$</p> <p>•² $k \cos a^\circ = 12$ and $k \sin a^\circ = 5$</p> <p>•³ 13</p> <p>•⁴ $22 \cdot 6$</p> <p>•⁵ 13, -13</p> <p>•⁶ maximum at $337 \cdot 4$ and no others</p> <p>•⁷ minimum at $157 \cdot 4$ and no others</p> <p>or</p> <p>•⁶ $337 \cdot 4$ and $157 \cdot 4$ and no others</p> <p>•⁷ maximum at $337 \cdot 4$ and minimum at $157 \cdot 4$</p>
12 P1 Q22	<p>use compound angle formula</p> <p>compare coefficients</p> <p>process k</p> <p>process a</p> <p>interpret y-intercept</p> <p>strategy for finding roots</p> <p>state both roots</p>	<p>•¹ $k \cos x \cos a - k \sin x \sin a$ stated explicitly</p> <p>•² $k \cos a = 1$ and $k \sin a = \sqrt{3}$ stated explicitly</p> <p>•³ 2 (do not accept $\sqrt{4}$)</p> <p>•⁴ $\frac{\pi}{3}$ but must be consistent with •²</p> <p>•⁵ 1</p> <p>•⁶ e.g. $2 \cos\left(x + \frac{\pi}{3}\right) = 0$ or $\sqrt{3} \sin x = \cos x$</p> <p>•⁷ $\frac{\pi}{6}, \frac{7\pi}{6}$</p>
14 P2	<p>use compound angle formula</p> <p>compare coefficients</p> <p>process for k</p> <p>process for a</p> <p>interpret expression</p> <p>state maximum</p>	<p>•¹ $k \sin x^\circ \cos a^\circ - k \cos x^\circ \sin a^\circ$ stated</p> <p>•² $k \cos a^\circ = \sqrt{3}$ and $k \sin a^\circ = 1$ stated</p> <p>•³ 2 (do not accept $\sqrt{4}$)</p> <p>•⁴ 30</p> <p>•⁵ $4 - 5 \times 2 \sin(x - 30)^\circ$</p> <p>•⁶ 14</p>

PRE 2000 ANSWERS - Degrees

1	<p>•¹ $k \sin(x - a) = k \sin x \cos a - k \cos x \sin a$ stated explicitly</p> <p>•² $k \cos a = 2$ and $k \sin a = 5$</p> <p>•³ $k = \sqrt{29}$</p> <p>•⁴ $a = 68 \cdot 2$</p>	
2	<p>•¹ $\tan x = \frac{5}{2}$</p> <p>•² $x = 68 \cdot 2$</p> <p>•³ $k^2 = 25 + 4$ or $k = \frac{5}{\sin 68 \cdot 2}$</p> <p>•⁴ $k = \sqrt{29}$</p>	<p>•¹ $k^2(\sin^2 x + \cos^2 x) = 29$</p> <p>•² $k = \sqrt{29}$</p> <p>•³ $\tan x = \frac{5}{2}$ or $\sin x = \frac{5}{\sqrt{29}}$</p> <p>•⁴ $x = 68 \cdot 2$</p>

3	<ul style="list-style-type: none"> •¹ $k \cos a = 1$ •² $k \sin a = 3$ •³ $k = \sqrt{10}$ •⁴ $a = 71.6$ •⁵ maximum = $5 + \sqrt{10}$ •⁶ angle = 161.6° 		
4	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 40%; padding: 5px;"> use compound angle formula compare coefficients process for k process for a interpret expression state maximum </td> <td style="width: 60%; padding: 5px;"> <ul style="list-style-type: none"> •¹ $k \sin x^\circ \cos a^\circ - k \cos x^\circ \sin a^\circ$ stated •² $k \cos a^\circ = \sqrt{3}$ and $k \sin a^\circ = 1$ stated •³ 2 (do not accept $\sqrt{4}$) •⁴ 30 •⁵ $4 - 5 \times 2 \sin (x - 30)^\circ$ •⁶ 14 </td> </tr> </table>	use compound angle formula compare coefficients process for k process for a interpret expression state maximum	<ul style="list-style-type: none"> •¹ $k \sin x^\circ \cos a^\circ - k \cos x^\circ \sin a^\circ$ stated •² $k \cos a^\circ = \sqrt{3}$ and $k \sin a^\circ = 1$ stated •³ 2 (do not accept $\sqrt{4}$) •⁴ 30 •⁵ $4 - 5 \times 2 \sin (x - 30)^\circ$ •⁶ 14
use compound angle formula compare coefficients process for k process for a interpret expression state maximum	<ul style="list-style-type: none"> •¹ $k \sin x^\circ \cos a^\circ - k \cos x^\circ \sin a^\circ$ stated •² $k \cos a^\circ = \sqrt{3}$ and $k \sin a^\circ = 1$ stated •³ 2 (do not accept $\sqrt{4}$) •⁴ 30 •⁵ $4 - 5 \times 2 \sin (x - 30)^\circ$ •⁶ 14 		
5	<p>(a)</p> <ul style="list-style-type: none"> •¹ $k \cos x \cos \alpha + k \sin x \sin \alpha$ •² $k \cos \alpha = 2$ and $k \sin \alpha = 3$ •³ $k = \sqrt{13}$ •⁴ $\alpha = 56.3$ <p>(b)</p> <ul style="list-style-type: none"> •⁵ $\cos(x - 56.3)^\circ = \frac{0.5}{\sqrt{13}}$ •⁶ $x - 56.3 = 82.0, 278.0$ •⁷ $x = 138.3, 334.3$ 		
6	<ul style="list-style-type: none"> •¹ strategy: e.g. $k \sin(x - a)$ <i>stated or implied by •⁶</i> •² $k \sin x \cos a - k \cos x \sin a$ <i>stated explicitly</i> •³ $k \cos a = 2$ and $k \sin a = 3$ <i>stated explicitly</i> •⁴ $k = \sqrt{13}$ •⁵ $a = 56.3$ •⁶ $\sin(x - 56.3) = \frac{2.5}{\sqrt{13}}$ •⁷ $x - 56.3 = 43.9, 136.1$ <i>136.1 stated or implied by the appearance of 192.4 in •⁸</i> •⁸ 100.2° and 192.4° <p>OR</p> <ul style="list-style-type: none"> •⁷ $x - 56.3 = 43.9, x = 100.2^\circ$ •⁸ 192.4° <p>Alternate solutions</p>		

	$k \cos(x - a)$ $k \cos x \cos a + k \sin x \sin a$ $k \cos a = -3, k \sin a = 2$ $k = \sqrt{13}, \tan a = -\frac{2}{3}$ $a = 146.3$ $\cos(x - 146.3) = 0.693$ $x - 146.3 = 46.1, 313.9$ $x = 192.4, 460.2$ $x = 192.4, 100.2$	$k \sin(x + a)$ $k \sin x \cos a + k \cos x \sin a$ $k \cos a = 2, k \sin a = -3$ $k = \sqrt{13}, \tan a = -\frac{3}{2}$ $a = 303.7$ $\sin(x + 303.7) = 0.693$ $x + 303.7 = 43.9, 136.1$ $x = -259.8, -167.6$ $x = 100.2, 192.4$	$k \cos(x + a)$ $k \cos x \cos a - k \sin x \sin a$ $k \cos a = -3, k \sin a = -2$ $k = \sqrt{13}, \tan a = \frac{2}{3}$ $a = 213.7$ $\cos(x + 213.7) = 0.693$ $x + 213.7 = 46.1, 313.9$ $x = -167.6, 100.2$ $x = 192.4, 100.2$
7	<p>(a)</p> <ul style="list-style-type: none"> •¹ $k(\sin x \cos \alpha - \cos x \sin \alpha)$ or equivalent •² $k \cos \alpha = 3$ and $k \sin \alpha = 1$ •³ $k = \sqrt{10}$ •⁴ $\alpha = 18.4$ <p>(b)</p> <ul style="list-style-type: none"> •⁵ $\sqrt{10} \sin(x - 18.4)^\circ = \sqrt{5}$ •⁶ $\sin(x - 18.4)^\circ = \frac{1}{\sqrt{2}}$ or equivalent •⁷ 63.4 •⁸ 153.4 <p>(c)</p> <ul style="list-style-type: none"> •⁹ strategy stated or implied •¹⁰ $x \leq 63.4$ and $x \geq 153.4$ 		
8	<p>(a)</p> <ul style="list-style-type: none"> •¹ $k \cos x \cos \alpha - k \sin x \sin \alpha$ stated explicitly •² $k \sin \alpha = 3$ and $k \cos \alpha = 2$ stated explicitly •³ $k = \sqrt{13}$ •⁴ $\alpha = 56.3$ <p>(b)</p> <ul style="list-style-type: none"> •⁵ $\sqrt{13} \cos(x + 56.3)$ •⁶ $\text{Max} = \sqrt{13}$ and $\text{min} = -\sqrt{13}$ •⁷ $x = 303.7$ and no further answers •⁸ $x = 123.7$ and no further answers <p>(c)</p> <ul style="list-style-type: none"> •⁹ $\text{Min Value} = 0$ 		

9	<p>(a)</p> <ul style="list-style-type: none"> •¹ $\cos(x + 30)^\circ = \cos x^\circ \cos 30^\circ - \sin x^\circ \sin 30^\circ$ •² $\frac{\sqrt{3}}{2} \cos x^\circ - \frac{1}{2} \sin x^\circ$ •³ $2 \times \left(\frac{\sqrt{3}}{2} \cos x^\circ - \frac{1}{2} \sin x^\circ \right) - \sin x^\circ$ <p>(b)</p> <ul style="list-style-type: none"> •⁴ $k \cos x^\circ \cos \alpha^\circ - k \sin x^\circ \sin \alpha^\circ$ •⁵ $k \sin \alpha^\circ = \sqrt{3}$ and $k \sin \alpha^\circ = 1$ •⁶ $k = \sqrt{7} \overrightarrow{OG} = 426$ •⁷ $\alpha = 49.1$ <p>(c)</p> <ul style="list-style-type: none"> •⁸ $\sqrt{7} \cos(x + 49.1)^\circ = 1$ •⁹ $x = 18.7^\circ$ •¹⁰ $x = 243.1^\circ$
10	<p>(a)</p> <ul style="list-style-type: none"> •¹ area of triangle = $\frac{1}{2} \times 4 \times 4 \sin \theta$ or $2 \times \frac{1}{2} \times 4 \sin \frac{\theta}{2} \times 4 \cos \frac{\theta}{2}$ •² strategy for finding length of side of square or rectangle •³ for length of side or (length of side)² of square/rectangle •⁴ area of rectangle •⁵ simplifying <p>(b)</p> <ul style="list-style-type: none"> •⁶ strategy including expansion of $k \sin(\theta - \alpha)$ •⁷ $k \cos \alpha = 8$ & $k \sin \alpha = 16$ •⁸ $k = 8\sqrt{5}$ or equiv. •⁹ $\tan \alpha = 2 \Rightarrow \alpha = 63.4$ <p>(c)</p> <ul style="list-style-type: none"> •¹⁰ $8(2 + \sin \theta - 2 \cos \theta) = 30$ •¹¹ $8\sqrt{5} \sin(\theta - 63.4)^\circ = 14$ •¹² $\sin(\theta - 63.4)^\circ = 0.783$ •¹³ $\theta = 51.5 + 63.4 = 114.9$ <div style="margin-top: 20px;"> <p>Note : For •³ various forms of the length are</p> <p>square: $4 \sin \frac{\theta}{2}, \frac{2 \sin \theta}{\sin(90 - \frac{\theta}{2})}, \sqrt{16 - 16 \cos^2 \frac{\theta}{2}}$</p> <p>rect: $\frac{4 \sin \theta}{\sin(90 - \frac{\theta}{2})}, \sqrt{32 - 32 \cos \theta}$</p> </div>

11	<p>(a)</p> <ul style="list-style-type: none"> •¹ $k \cos 20t^\circ \cos \alpha^\circ + k \sin 20t^\circ \sin \alpha^\circ$ •² $k \cos \alpha^\circ = 1$ and $k \sin \alpha^\circ = \sqrt{3}$ •³ $k = 2$ •⁴ $\alpha = 60$ <p>(b)</p> <ul style="list-style-type: none"> •⁵ endpoints: (0,1) or (18,1) •⁶ zeros: (7.5,0) and (16.5,0) •⁷ stationary points: (3,2) and (12,-2) •⁸ correct annotation of graph <p>(c)</p> <ul style="list-style-type: none"> •⁹ $2 \cos(20t - 60)^\circ = 1.5$ •¹⁰ $20t - 60 = 41.4 \Rightarrow t = 5.1$ •¹¹ $20t - 60 = -41.4 \Rightarrow t = 0.9$
12	<div style="display: flex; justify-content: space-between;"> <div> <p>(a)</p> <ul style="list-style-type: none"> •¹ $k \cos 30t^\circ \cos \alpha^\circ + k \sin 30t^\circ \sin \alpha^\circ$ •² $k \cos \alpha^\circ = 1$ and $k \sin \alpha^\circ = \sqrt{3}$ •³ $k = 2$ •⁴ $\alpha = 60$ <p>(b)</p> <ul style="list-style-type: none"> •⁵ maximum at (2,2) •⁶ minimum at (8,-2) •⁷ endpoints: (0,1) or (12,1) •⁸ graph correctly annotated with 3 points •⁹ sketch with original amplitude increased by factor of 60 •¹⁰ sketch with original graph translated $\begin{pmatrix} 0 \\ 200 \end{pmatrix}$ </div> <div> <p>(c)</p> <ul style="list-style-type: none"> •¹¹ 0800 hours <p>(d)</p> <ul style="list-style-type: none"> •¹² 5.6 hours and 10.4 hours •¹³ e.g. between 5am and 11am </div> </div>
13	<p>(a)</p> <ul style="list-style-type: none"> •¹ $a = 3$ •² $b = 2$ •³ $c = 3$ •⁴ $d = 3$ <p>(b)</p> <ul style="list-style-type: none"> •⁵ $p = 3$ •⁶ $q \sin(px + r)^\circ$ $= q \sin px^\circ \cos r^\circ + q \cos px^\circ \sin r^\circ$ •⁷ $q = \sqrt{13}$ •⁸ $q \cos r^\circ = 2, q \sin r^\circ = 3$ or $\tan r^\circ = \frac{3}{2}$ •⁹ $r = 56.3$

PRE 2000 ANSWERS - Radians

1	<p>use compound angle formula</p> <p>compare coefficients</p> <p>process k</p> <p>process a</p> <p>interpret y-intercept</p> <p>strategy for finding roots</p> <p>state both roots</p>	<p>•¹ $k \cos x \cos a - k \sin x \sin a$ stated explicitly</p> <p>•² $k \cos a = 1$ and $k \sin a = \sqrt{3}$ stated explicitly</p> <p>•³ 2 (do not accept $\sqrt{4}$)</p> <p>•⁴ $\frac{\pi}{3}$ but must be consistent with •²</p> <p>•⁵ 1</p> <p>•⁶ e.g. $2 \cos\left(x + \frac{\pi}{3}\right) = 0$ or $\sqrt{3} \sin x = \cos x$</p> <p>•⁷ $\frac{\pi}{6}, \frac{7\pi}{6}$</p>
2	<p>(a)</p> <p>•¹ $\sin p = \frac{\text{"hor"}}{2}$ and $OB = 1 + \text{"hor"}$</p> <p>•² $OC = 1 + 2 \cos p$</p> <p>•³ $d^2 = (1 + 2 \cos p)^2 + (1 + 2 \sin p)^2$ and completes proof</p> <p>(b)</p> <p>•⁴ $k \cos(p - \alpha) = k \cos p \cos \alpha + k \sin p \sin \alpha$</p> <p>•⁵ $k \cos \alpha = 4$ and $k \sin \alpha = 4$</p> <p>•⁶ $k = 4\sqrt{2}$</p> <p>•⁷ $\alpha = \frac{\pi}{4}$</p> <p>•⁸ maximum value = $6 + 4\sqrt{2}$</p> <p>•⁹ occurs when $p = \frac{\pi}{4}$</p> <p>(c)</p> <p>•¹⁰ $OB = 1 + 2 \sin \frac{\pi}{4}$ and completes proof</p> <p>•¹¹ $BD = (1 + \sqrt{2}) \times \frac{1}{\sqrt{2}}$</p> <p>•¹² $BC = 2 + \sqrt{2}$</p> <p>•¹³ $6 + 4\sqrt{2} = (2 + \sqrt{2})^2$ so $\sqrt{6 + 4\sqrt{2}} = 2 + \sqrt{2}$</p>	